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(54) A PROCESS FOR THE AGGLOMERATION OF FINES OF PYRITE ORES

(71) We, EMPRESA AUXILIAR DE LA INDUSTRIA, S.A., a Spanish Corporation of Plaza de Salamanca 8, Madrid, Spain, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a process for the agglomeration of fines of pyrite ores.

The presence of a high percentage of "fines" in the "whole" resulting from the excavation in mines, and still more, from the grinding of pyrite ores, causes various difficulties in previous processes to smelt them: first in transport, afterwards in storage, storing and feeding of the furnace, and later during roasting, by causing combustion in undesired zones of the installation.

The problems are greatest if fines of pyrite ores proceeding from flotation are roasted, because this material could not be treated in all cases in the conventional roasting furnaces hitherto.

The technical solution, which at the moment is given to these problems, consists in separating the fines from the rest of the ore which consequently affects the cost of operation and decreases the yields of exploitation of the ore.

The process proposed by us for the treatment of the fines makes it possible to use all of the ore extracted from the mine, whatever its granulometric composition may be. It is thus not necessary to separate the fine fractions to use all the pyrites which use only depends on the composition of the ores and not on the available range of sizes.

According to the present invention we provide a process for the agglomeration of fines of pyrite ores, wherein the particles of the ore are moistened with an aqueous solution of ferrous sulphate, ferric sulphate or calcium chloride or a mixture of such salts and thereafter the mixture is pelletized and the obtained pellets dried.

The aqueous solution used as the moistening agent may be for example the leaching liquors of cinders, and also the residual leaching liquors of the paper industry. If the object is to agglomerate pyrites of flotation or ores which, owing to different sources, are partially sulfated, very dilute solutions of the said substances can be used as a moistening agent. Sometimes it is convenient to reinforce the action of these liquid additions by also adding solid agglomerating products of the clay type, such as the bentonites.

It is preferred to use solutions of ferrous and/or ferric sulphate having concentrations higher than 10% by weight and solutions of calcium chloride having concentrations higher than 15% by weight as the moistening agent. It has been found preferable to incorporate aqueous solutions in a proportion variable between 8 and 15% in weight, referred to the dry mineral. Besides this the addition of bentonite contributes to preserve to "green" pellet till the drying of same, which can be carried out at approximately 120—150°C, as this will make the pellet sufficiently hard.

It will be observed that among the cited liquid substances are solutions, which, besides their conglomerating action, contain elements which help to dissolve the non-ferrous metals. Therefore, in some of its variants this invention has special interests for the use of the fines of pyrites which are impregnated with Cu, Zn, Pb.

These solubilizing agents may be added in solution, as a moistening liquor in order to produce the pellets of the mineral.

In order to use the fines of pyrites, this new process can also be applied to a wider range of sizes, provided that the proportion and the fineness of the smaller sizes be sufficient to enable the bigger grains to act as germs of growth for the pellets to be obtained, moistening the "whole" with the proposed solutions and by means of any of the mentioned conventional techniques.

It is convenient to dry the agglomerates or pellets obtained if they must be charged

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and transported. However, the roasting furnaces of any type can be charged with pellets which have not passed through the drying phase. These pellets are adequate for hearth roasters (mechanical), fluidized furnaces and flash roasters, because the size of the agglomerate can be prepared suitable for each one of the furnaces, if the roasting is effected in hearth roasters, the pellet size, which can be utilized for the roasting, can be such that at the end of the process of integral utilization (roasting-lixiviation) an iron ore is obtained with the adequate size to be charged directly to the blast furnace. Because it happens that the agglomerated ore, as mentioned before, maintains the form and size of its nodules or pellets, during the roasting process, therefore, these pellets can be lixiviated by percolation. Subsequently, the roasted and lixiviated pellets impregnated by the lixiviating solutions or washing liquors are first dried in order to eliminate moisture and later burned to a burning at temperatures of approximately 1300°C, which gives them sufficient mechanical resistance in order to operate the charges, to which they will be submitted in the blast furnace. Evidently, this conditioning can be unnecessary, or not so severe, if the furnace, in which the metallic iron has to be obtained, is different from the blast furnace.

Naturally, the method described for the iron sulfides is applicable to other minerals of metallic sulfides such as blendes, galenas, chalcosine and chalcopyrites.

In order to make the before mentioned description clearer, we enclose some practical examples of how to realize the invention, which, of course, is not bound to the limitations of the same.

Example 1

The granulometric composition of the pyrite ores to be treated, referred to percentages in weight, is as follows:

More than 1 mm	0.0%
Between 1 mm and 0.50 mm	38.6%
Between 0.5 and 0.25 mm	11.7%
Between 0.25 and 0.105 mm	26.3%
Less than 0.105 mm	23.4%

and its chemical composition is expressed in the following table:

Sulfur	46.0%
Iron	42.3%
Arsenic	0.8%
Lead	1.3%
Zinc	1.4%
Copper	0.9%
Other components and insoluble gangue	7,3%

Each ton of the ore is mixed with 10 kg of $CaCl_2$ and the mixture is moistened and pelletized with 70 l of residual leaching liquors from the paper production by alkaline methods (for example "to the sulfate").

In the roasting of these pellets, cinders are produced which maintain the initial form of the pellet and which are constituted by a matrix of iron oxide impregnated by soluble forms—chlorides or sulfates—of the metallic non-ferrous compounds, which facilitates the subsequent lixiviation, and by oxides of calcium, which act as agglomerating and fusing agent of the cinders. The metallic non-ferrous elements are extracted by lixiviation, to give a "purple ore" in the form of pellets, whose mechanical resistance immediately is elevated by burning them at approximately 1250°C, so as to obtain a product fit to be fed into the blast furnace.

Example 2

"Fines" are available, proceeding from a grinding installation and classification of pyrites, having a particle size of less than 0.3 mm. In order to form nodules of sizes between 2 and 15 mm, the fines are moistened with a saturated solution of ferrous sulfate in the proportion of 70 l of solution per ton of pyrites, and the mixture is led to a pelletization apparatus.

The obtained pellets are burnt in hearth roasters and their cinders are lixiviated by percolation. Finally, the pellet of the "purple ore" is dried at 150°C and subjected to burning at 1250°C, being fit to be used in the blast furnace. These pellets have an iron content higher than that of the normal cinders, because they contain the iron of the ferrous sulphate.

Example 3

Flotation pyrites are available whose chemical composition is as follows:

Sulfur	47.7%
Iron	43.9%
Arsenic	0.8%
Other components and insoluble gangue	7.6%

This mineral is moistened with a solution of bivalent sulfate of iron (10% by weight), in a proportion of 70 l of solution per ton of pyrite, which is 10.9 kg per ton. The mixture is led to a dish-type pelletizer, where nodules are formed with a diameter between 5 and 15 mm. The pellets, after a previous drying, are burnt. The cinders have the chemical and granulometric properties to be utilized in the blast furnaces.

What we claim is:—

1. A process for the agglomeration of fines of pyrite ores, wherein the particles of the are as moistened with an aqueous solution

of ferrous sulphate, ferric sulphate or calcium chloride in a mixture of such salts, and thereafter the mixture is pelletized and the obtained pellets dried.

2. A process according to claim 1, wherein the solution of the ferrous and/or ferric sulfate utilized as moistening agent has a concentration higher than 10% by weight.

3. A process according to claim 1, wherein there is used as a moistening agent a solution of calcium chloride in concentration higher than 15% by weight.

4. A process according to claim 1, wherein the solution of iron sulfate utilized as moistening agent is one which contains iron ions resulting from the recuperation of the non-ferrous metallic elements from the final leaching liquors proceeding from the lixiviation of cinders.

5. A process according to claim 1, wherein there is utilized as a moistening agent the residual leaching liquor of the paper industry.

6. A process according to any preceding claim, wherein a solid, finely-divided product of clay character, such as bentonite, is added to the solution.

7. A process according to any preceding claim, wherein the agglomeration of the fine fractions of the mineral is effected together with fractions of larger grains, in such a manner that the fines cover the larger grains thus increasing the average size of the fraction.

8. A process for the agglomeration of pyrite ores according to any one of the Examples.

9. Pellets obtained by the method of any one of the preceding claims.

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